AU/ACSC/0133/97-03

THE EVOLVED EXPENDABLE LAUNCH VEHICLE (EELV) ACQUISITION AND COMBAT CAPABILITY

A Research Paper

Presented To

The Research Department

Air Command and Staff College

In Partial Fulfillment of the Graduation Requirements of ACSC

by

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March 1997

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
00031997	N/A	-

Title and Subtitle The Evolved Expendable Launch Vehicle (EELV) Acquisition and combat Capability	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Greaves, Samuel E.	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Air Command and Staff College Maxwell AFB, Al 36112	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UNLIMITED
Number of Pages 58	

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Preface

Over the past 15 years I have been continuously involved, in one way or another, with the United States space program. These experiences included spacelift assignments within the Space Shuttle and Titan 34D/Titan IV programs at both east and west coast spaceports. I have also held spacecraft acquisition, launch operations, and staff jobs within the Secretary of the Air Force Office of Special Projects. Consequently I became familiar with the systems launching the nation's highest priority payloads into orbit. I also gained a tremendous amount of appreciation for the effort needed to get these assets safely into space using the currently available launch systems.

During this time I essentially accepted these systems and their extensive ground processing requirements as the way to conduct spacelift operations. It was not until my assignment to the Directorate of Requirements at Air Combat Command (ACC/DR) that I began to seriously question this way of doing business. The warfighters at ACC/DR motivated me to question within my own mind the real purpose and mission of DOD spacelift. Where previously I associated this mission with only the safe delivery of a satellite to a prescribed orbit, I now understand that spacelift has an additional and very real warfighting mission. This mission requires rapid, responsive, flexible, and cost effective support for the combatant commander. I now realize that space assets can tremendously impact the theater campaign if they are available when called upon, and it is up to the spacelifters to ensure there exists an on-demand space asset delivery capability.

The Evolved Expendable Launch Vehicle acquisition program is a major near-term effort with the potential to provide this vital support to the combatant commander. The focus of this study is to offer a prediction on how well this launch system will satisfy the needs of the combatant commander.

This paper was both a challenge and an extremely worthwhile task, and could not have been accomplished without significant help and inspiration from others. I would like to thank Maj Edward Greer of the ACSC faculty for developing the idea for this paper, and for serving as my faculty advisor on this project. He was instrumental in providing significant guidance during its development and gave quite a bit of his time reviewing drafts and providing comments. Also, a very special thanks to my wife Patricia, my son Christopher, and my daughter Stephanie for their unfailing support during this demanding year at ACSC. We could only have done it as a team.

It is my hope that EELV program personnel will use the information in this paper to initiate a relook at the rationale and requirements for the EELV program. This is needed to ensure that the acquisition community delivers a launch system that can truly support the needs of the combatant commander.

Abstract

This project studies the Evolved Expendable Launch Vehicle acquisition program. The purpose is to find out how the EELV proposes to deliver assured access to space with significant savings. This is being done in order to understand whether the delivered system will significantly enhance spacelift's contribution to the combatant commander's mission.

The paper accomplishes five tasks. First, it describes the top-level policy guiding the EELV program. Second, it examines a number of applicable lessons learned from a prior similar acquisition program. Third, it outlines the proposed EELV solution by examining the contractually binding system performance document. Fourth, it assesses the ability of the EELV solution to meet warfighter requirements. Finally, it provides recommendations aimed at modifying the acquisition program to meet the warfighter's needs, and educating the warfighter on what the EELV will most likely deliver.

One of the significant findings is that the EELV is a conservative, interim access to space solution that will not revolutionize spacelift. This means that if space assets fail during deliberate or crisis action planning, the combatant commander cannot assume that a replacement will be readily available because the EELV system is not being optimized to provide such service. It is only being optimized to reliably place assets into space at some reduced cost. This shortfall in responsiveness and timelines may preclude the full application of space power because space assets may not be available when needed by the

combatant commander. Also, the requirements flowed down to the contractually binding system performance document reflect a cautious, conservative tone, and not the high operations tempo of the joint warfighting environment. Additionally, acquisition streamlining principles must be properly applied throughout all aspects of the program in order to deliver a program that has any hope of meeting the 25 to 50 percent cost reduction goals.

Finally, if space superiority is truly a core competency the Air Force intends to incorporate into the combatant commander's toolkit, then there is a bona fide need for the acquisition of a rapid, responsive spacelift system. The EELV will not be able to meet these requirements unless its system performance documents are modified to identify these capabilities as key performance parameters on the EELV contract.

Chapter 1

Introduction

The bottom line is everything on the battlefield is at risk without Air and Space Superiority...Operations that now focus on air, land and sea will ultimately evolve into space.

—*Global Engagement: A Vision for the 21st Century Air Force*

Statement of the Research Question

This paper examines the EELV acquisition program. The purpose is to find out how the EELV proposes to deliver assured access to space with significant savings. This is being done in order to understand whether the delivered EELV system will significantly enhance spacelift's contribution to the combatant commander's mission.

The study accomplishes five tasks. First, it describes the top-level policy guiding the EELV program. Second, it examines a number of applicable lessons learned from a prior similar acquisition program. Next, it outlines the proposed EELV solution by examining the contractually binding system performance document. Fourth, it assesses the ability of the EELV solution to meet warfighter requirements. Finally, it provides recommendations aimed at modifying the acquisition program to meet the warfighter's needs, and educating the warfighter on what the EELV will most likely deliver.

Background and Significance of the Problem

Summary of Significant Events

A number of events over the past eleven years served to redefine the role and value of space based assets in the minds of the United States military and the American people. These events began with the Space Shuttle Challenger accident in 1986, and the two Titan 34D launch failures of 1985 and 1986. A few years later, two other influential events were the Desert Storm war in 1991, and most recently, President Clinton's 1994 National Space Transportation Policy (NSTP).

Launch Failures. The Titan and Space Shuttle launch failures sent alarm bells ringing through the halls of the Pentagon and national intelligence communities. They realized that these launch vehicle failures had effectively eliminated the ability to place the nation's highest priority satellites into orbit. To solve this problem, the DOD embarked on a heroic spacelift recovery effort, culminating with the successful launch of the Titan 34D-15 vehicle in September 1987.

After this success, the DOD continued to painstakingly reestablish its space launch capability with additional Titan 34D successes, and with the eventual return of the space shuttle fleet to operational status. These accomplishments cost the taxpayer a great deal in dollars and time. Space-launch capability during this period, although successful, was neither timely, responsive, nor robust. The DOD, however, had already initiated the Complementary Expendable Launch Vehicle (CELV) acquisition program aimed at correcting these deficiencies with the goal of regaining assured access to space.

The overall aim of the CELV concept was to preserve the space-launch options for our nation's highest priority payloads. The DOD, and in particular, Under Secretary of the Air Force Edward C. Aldridge, saw "assured access to space [as] the key ingredient to the DOD space program. [He felt that] the space shuttle and the CELV [were] important parts of that objective, since a problem with one would not affect the other."[1] The CELV program, as conceived, sought to streamline the acquisition process to deliver an alternative launch vehicle at lower cost to the government.

Desert Storm. While the space-launch community continued to make slow progress, the next major event in the series, the Desert Storm coalition war against Iraq, showcased the capabilities and potential for waging and winning wars from space. In this war, the multinational coalition dominated and exploited the space environment over the theater, resulting in almost total situation awareness of enemy activities. The only limitations in this regard lay with the capabilities of coalition space-based sensors, and problems associated with an immature information dissemination architecture to the theater.

The end result of this experience was a general appreciation that "the control of air and space is a critical enabler for the Joint Force because it allows all US forces freedom from attack and freedom to attack."[2] The DOD understood the *'air'* piece of the equation prior to this conflict, but it was the *'space'* piece that now sharply came into focus, and under scrutiny.

Post Desert Storm. A number of studies then examined our present and future space-based capabilities. The results of these efforts were summed up by Gen Thomas S. Moorman, Vice Chief of the Air Force, who stated "there is a broad national security issue here. The United States is the premier spacefaring nation in the world...We build the best satellites. . . . We do it all here. . . . But a very important component of spacepower is launch, and [it is] here we're falling behind."[3]

It became clear that in order to maintain space superiority, we needed to fix the launch problem. According to General Moorman, we needed to correct "serious deficiencies in space launch, [which] if left uncorrected, [would] have profound impacts on the nation's future space program."[4] The culmination of these studies of the launch problem came on 5 August 1994, when President Bill Clinton signed the National Space Transportation Policy (see Appendix A).

National Space Transportation Policy (NSTP). This presidential policy statement set the tone and direction of our current space-launch strategy. It states that "the United States space program is critical to achieving US national security, scientific, technical, commercial, and foreign policy goals. Assuring reliable and affordable access to space through US space transportation capabilities is a fundamental goal of the US space program."[5] This policy places access to space as a vital national interest, and further recognizes that space transportation is a key enabler of space superiority.

Launch Capability and Global Engagement

Global Engagement: The Air Force Vision for 21st Century Warfare, anticipates the critical role of air and space power in both influencing national policy and in determining the outcome of future conflicts. To this end, the Air Force, as the lead agent for the Department of Defense, is currently spearheading the acquisition of a key enabler for the nation's 21st century space-based military capability—the Evolved Expendable Launch Vehicle. The DOD, as outlined in *Joint Vision 2010*, identifies the control and exploitation of space as critical to the realization of Full Spectrum Dominance (FSD), and that in order to achieve FSD, there must be cost effective, reliable, and responsive access to space. This is the requirement set the EELV must satisfy if spacelift is to reach its warfighting potential. The combatant commander must not wait until the EELV system is delivered to comprehensively assess its contribution to the space superiority mission. If program changes must be made, they should be made now, and it is the purpose of this paper to make such an assessment—warfighter lives may depend on it.

Limitations of the Study

This study clearly cannot cover the full range of influences on the EELV program. The paper therefore limits itself to two of the major elements shaping EELV capability. These are the EELV requirements themselves and the acquisition process. The central rationale is that one may reliably predict the delivered capability of an end item by examining both the agreed-to requirements and the process used to buy the end item. The author admits that in some cases, such influences as regional politics and congressional budget fluctuations, can have a significant influence on the end item. However, due to the national importance of this system, the two most significant forces shaping the EELV are undoubtedly the system's requirements and acquisition streamlining principles.

Preview of the Argument

Managers within the highest levels of the military acquisition community view the EELV program as a model for streamlined acquisition, with the ultimate goal of reducing launch costs. However, unless they take steps to realign some of the more critical requirements in the contractually binding EELV System Performance Document, the program may fail to produce the anticipated increase in space-based combat capability.

This realignment will allow the EELV acquisition community to deliver a spacelift system that can be integrated into the Joint Operations Planning and Execution System (JOPES) used by the combatant commanders in planning their responses to contingencies. Along with cost savings, the integration of spacelift into the joint operations planning environment must become one of the program's measures for success. This must be accomplished if space superiority is truly to remain an Air Force warfighting core competency.

Notes

[1]Edward C. Aldridge Jr., "An Assured Space Launcher for DOD," *Defense 85*, August 1985, 12.

[2]Department of the Air Force. *Global Engagement: A Vision for the 21st Century Air Force*, 1997, 10.

[3]Bill Gertz, "What Next for Launchers," *Air Force Magazine*, November 1994, 56.

[4]Ibid., 57.

[5]The White House, "Fact Sheet—Statement on National Space Transportation Policy," 5 August 1994, n.p.; on-line, Internet, 8 February 1997, available from http://www1.whitehouse.gov/WH/EOP/OSTP/other/launchstfs.html.

Chapter 2

What's Driving the DOD Acquisition of the EELV?

The medium of space is one which cannot be ceded to our nation's adversaries. The Air Force must plan to prevail in the use of space.

Global Engagement: A Vision for the 21st Century Air Force

The genesis of our nation's current strategy for space launch is the National Space Transportation Policy signed by President Bill Clinton on 5 August 1994. According to the statement released by the White House, the NSTP "sets a clear course for the nation's space program. [It provides] a coherent strategy for supporting and strengthening US space-launch capability to meet the growing needs of the civilian, national security, and commercial sectors."[1] The NSTP was significant because it clearly described the space launch roles and relationships between the DOD, the National Aeronautics and Space Administration (NASA), the civil sector, and the commercial sector. Paraphrasing from the NSTP statement, this policy commits the nation to a two-track spacelift strategy. First, it requires maintaining and improving the current fleet of expendable launch vehicles as necessary to meet the needs of all four user communities. Second, it requires investing research and development resources in developing and demonstrating next generation reusable space transportation systems with the potential to greatly reduce the cost of access to space.[2] The national strategy therefore attempts to reach out and compromise with each of the major players in the space launch arena. The question then becomes—is this acquisition effort just politics, or is it the correct answer for the nation?

Conservative Near-Term Solution

Claim

The EELV program is the result of a conservative national space-launch policy and is primarily a near-term interim solution to the problem of high launch services costs.

Evidence

The United States currently uses a mix of Expendable Launch Vehicles (ELVs) and a Reusable Launch Vehicle (RLV), the space shuttle, to get its payloads into space. Of these two capabilities, the current ELVs descended from converted Intercontinental Ballistic Missile Systems (ICBMs), and primarily consists of the Atlas, Delta, and Titan space launch systems. Since they "were not originally built to lift payloads into space, these ELV systems [have become] costly, lack most modern space launch features, have relatively low reliability getting off the launch pad, and require a large, cost-ineffective infrastructure of technicians and facilities."[3]

In an attempt to preserve our options for spacelift in a fiscally constrained environment, the President, by approving the NSTP in 1994, took a relatively small and very conservative step towards improving launch operations. He chose to evolve current expendable launch capabilities to meet the interim spacelift requirements. This gave NASA the time to explore and develop a longer term RLV solution aimed at drastic reductions in the cost of space launch. The rationale for this conservative approach, as opposed to one that would seek to revamp our near-term space launch capability, is rooted deeply in one of our most significant space launch events of the last decade—the Space Shuttle Challenger launch vehicle accident.

This launch failure in January 1986, and the resulting stand-down of space shuttle operations, placed increased emphasis and reliance on the ELV fleet. This was especially true to get our critical national security payloads into space. The ELV became the nation's only heavy-lift means to get these national security payloads into orbit. This emphasis and increased reliance on the ELV fleet resulted in several studies examining the reliability, robustness, and cost effectiveness of ELV operations. By 1994, these studies concluded that "the US launch industry, with origins in 1950s-era ICBMs, featured long delays and manpower intensive operations, leading to high cost and unhappy customers."[4]

Among the various alternatives explored as solutions to this dilemma, three options were available to the President in 1994 as he attempted to provide national level strategic policy direction to the United States space launch effort. The options were varied, but comprehensive in scope. Additionally, all pursued an end state national capability to deploy space systems at drastically reduced costs. These options were also common in their inclusion of a Reusable Launch Vehicle as the long-term answer. This is not surprising since "most experts agree that the optimum solution for [space launch] is to employ a RLV with airplane-like operation."[5] NASA was then tasked to "focus their investments on technologies to support a decision no later than December 1996 on whether to proceed with a [RLV] flight demonstration program. This program would, in turn, provide the basis for deciding by the end of the decade whether to proceed with a new launch system to replace the aging shuttle fleet."[6] The problem then became one of defining the launch vehicle system to sustain the nation's space launch capability during the interim period.

As stated earlier, there were three options for sustainment during the interim period. First, the nation could continue operating with current ELV capabilities while pursuing the RLV. Second, it could maintain and continue to optimize the current fleet of ELVs (Atlas, Delta, and Titan), while pursuing the RLV. Finally, it could choose to evolve the current fleet into a more cost-effective space launch capability while pursuing the RLV.

The President also faced several issues during the review and assessment of these options. These issues included the very real requirement and dependence of our national security payloads on specific launch systems. They also included the ever rising costs of space-launch, and the risks to national security from the failure to complete an ambitious acquisition program aimed at producing a completely new launch capability.

The overriding concerns were to protect access to space while reducing overall launch costs. On the one hand, "the driving requirement for an improved assured access to space derives from the ever-increasing importance of space assets to our national security."[7] While on the other hand, ever-increasing launch costs themselves resulted in the emphasis to control and reduce launch costs. In light of these two significant influences on policymaking, the national space policy would need to be cautious in the near term, while seeking radical and significant cost reductions and mission improvements in the future.

The choice for a selected option lay not only with the two-pronged strategy outlined earlier, but also with one of the objectives of the NSTP. Section II of the NSTP states that "the objective of DOD's effort to improve and evolve current ELVs is to reduce costs while improving reliability, operability, responsiveness, and safety."[8] Cost then became the primary reason for choosing the evolutionary path outlined in the NSTP. The effort to reduce costs would overarchingly seek to "evolve satellite, payload, and launch vehicle designs to achieve the most cost-effective and affordable satellite, payload, and launch vehicle combination, [an integrated package]."[9] Option three was therefore the preferred NSTP solution.

A Family of Launch Vehicles

Since the outset of the EELV requirements definition and subsequent development program to meet the near-term NSTP requirements for reduced launch systems costs, the discussion revolved around two possible design solutions. These were to: (1) build a single ELV to satisfy all medium and heavy-lift users; or (2) develop a family of launch vehicles based on some common existing program elements.

Claim

Of these two options, the second option, which fields an EELV family of vehicles based on common "core" components is the better choice when examined against the cost reduction goals and conservative strategic direction provided by the NSTP for the EELV program.

Evidence

The NSTP policy directive to "improve and evolve current ELVs to reduce costs while improving reliability, operability, responsiveness, and safety," provided the top-level guidance on how to begin redefining our space launch capability.[10] Using this statement as a departure point, the number one goal of the strategy was to reduce launch costs while simultaneously, as the wording above clearly expresses, “improving and evolving” current ELV designs and systems. This guidance set the outer limits of what would be an acceptable solution for the EELV. The significance of this restriction is that although the DOD is tasked to reduce costs, it would not have the total flexibility to accept or seriously investigate radically new or risky concepts that had a large future payoff potential.

One of the other main requirements guiding the design of the EELV system is the vision that the program will “provide a more competitive commercial launch capability for the United States. The EELV program [will be] actively involved in addressing the commercial industry’s interface requirements.”[11] So not only will the EELV have to satisfy the government’s spacelift requirements, the NSTP also envisions the commercial industry becoming a significant user of the launch system. The system therefore aims to meet the expendable spacelift requirements outlined in the national mission model (NMM), and drive down average launch costs through economies of scale. According to Dr. Sheila Widnall, Secretary of the Air Force, “[we] expect the EELV program to produce a commercial booster the military can use, or a military booster the commercial industry can use—the epitome of dual use technology.”[12]

As the design concepts are being examined for the EELV, it’s quite easy to see why radical designs or concepts would not seriously compete with the existing tried and true launch vehicle systems. It was clearly preferable, under the NSTP guidance, to propose an existing system with a proven track record, which would be improved or evolved, to produce a predicted additional reduction in launch costs to the user, while minimizing the risks of failure.

As far as the option to develop a single launch vehicle system to satisfy both the medium and heavy lift payload requirements, the limiting factor to the viability of this option becomes the cost of launch services to get the payload into orbit. An illustration of the effect of launch services costs on the choice for an EELV solution becomes apparent if one examines requirements and options for getting payloads into the Low Earth Orbit (LEO) regime.

In his essay, *LEO on the Cheap: Methods for Achieving Drastic Reductions in Space Launch Costs*, Lt Col John London III performed an excellent top level analysis on how to begin deriving comparative launch services costs of getting to LEO for each of the major existing space launch systems. He began by stating that "establishing the actual cost per launch of expendable launch vehicles can be a challenging task. Launch expenses are strongly influenced by the options each vehicle manufacturer makes available to prospective customers."[13] These options include the types of upper stages, payload fairings, payload weight accommodated, and choices of prelaunch test programs. Each launch vehicle contractor deals with these variables differently.

Although the attempt to compare launch vehicle costs may appear to be a prohibitive task, Colonel London produced approximate launch service prices for a number of ELVs. His effort includes estimates for the range of capabilities of interest to the EELV program. The Delta II 7920, Atlas IIA, and the Titan IV systems presently cover this range of capabilities. The cost figures expressed below are in 1993 dollars.

Delta II 7920. This launch system "has a liquid-propellant core stage that uses liquid oxygen and RP-1, and it employs nine solid-propellant strap-on motors with graphite epoxy cases. The vehicle does not use an upper (third) stage. The particular configuration example under consideration employs a nine and one-half foot diameter payload fairing. The price for Delta II 7920 launch services is in the $45—$50 million range."[14]

Atlas IIA. "The Atlas IIA is a more powerful launch vehicle than the Delta II 7920. The configuration selected uses an 11-foot diameter payload fairing. Launch services cost between $80 and $90 million."[15]

Titan IV. "Still more powerful is the Titan IV...The configuration chosen for comparison, which uses no upper stage, has a 16.7 foot diameter payload fairing. Launch services cost between $170 and $230 million per mission."[16]

One should examine an additional criterion before using these cost estimates as a way to determine whether a single launch system, as opposed to a family of launch vehicles, would be the preferred option for the EELV solution. This criterion concerns the payload weight requirements outlined in the LEO portion of the NMM assigned to the EELV.

If the DOD selected a single launch system as the EELV solution, then this system would be expected to accommodate both the medium and heavy lift payload requirements. Using existing systems as a comparison, this immediately eliminates the medium lift Atlas IIA and Delta II 7920 capabilities from consideration. Since they are unable to meet the heavy-lift requirements, the only viable candidate becomes the Titan IV class launch system. It becomes the only possible way to get the nation's heaviest payloads into LEO, and also requires it to service both the medium and heavy lift user requirements.

The major implication of selecting the single launch system as the solution is that it forces all users to pay the same amount to get their payloads into orbit. The most likely source of cost savings with this system is ridesharing. For example, a GPS satellite using the Delta II 7920 class vehicle, per the estimates above, would be paying \$45—\$50 million to get into space. If a user was forced to use the single EELV launch system option outlined above, a worst-case scenario could see those costs rise into the \$170—\$230 million range. This is more than a fourfold estimated increase in launch costs for getting the same satellite into space as compared with using the smaller Delta class launch vehicle.

A more realistic scenario would probably result in reduced costs due to economies of scale from a higher launch rate, however, the average costs would still be much greater than charged today. In situations as this, such an increase in the cost of the launch vehicle portion of a space program may be enough to eliminate the viability of the program itself.

Although this may appear to be a fairly simplistic illustration, the principle remains the same even if one performs a more rigorous analysis. The lesson is that one must tailor space launch options to fit the requirements. If this is not done, then cost will definitely become *a* driver, if not *the* driver, in determining whether the user can maintain a viable program.

Therefore, even if the government entertains the more expensive option, it's absolutely clear that the commercial industry would not tolerate nor even consider a launch system option requiring them to pay up to an average of four times more than what it's currently costing them to deliver the same payload to the same orbit today. This fact is then the most convincing argument against the single launch system solution for the EELV.

It should be clear by this point that the top-level requirements driving the EELV program emphasize the reduction in launch costs as a primary goal for the program. Concurrent with this strategy is additional NSTP guidance to follow a low-risk approach involving the evolution of current spacelift capabilities. This evolutionary approach is unlikely to independently produce significant cost savings, so another major goal is to derive these savings from the acquisition process itself by implementing streamlining principles. The next chapter will therefore address the impact of this streamlined process on the EELV end-item.

Notes

[1]The White House. "Statement on National Space Transportation Policy," 1994, n.p.; on-line, Internet, 11 February 1997, available from http://www1.whitehouse.gov/WH/EOP/OSTP/other/launchst.html.

[2]Ibid.

[3]Bill Gertz, "What Next for Launchers." *Air Force Magazine,* November 1994, 57.

[4]Suzann Chapman, "Toward Leaner Launchers," *Air Force Magazine*, July 1996, 73.

[5]Ibid., 76.

[6]The White House. "Statement on National Space Transportation Policy," 1994, n.p.; on-line, Internet, 11 February 1997, available from http://www1.whitehouse.gov/WH/EOP/OSTP/other/launchst.html.

[7]Edward C. Aldridge Jr., "An Assured Space Launcher for DOD," *Defense 85,* August 1985, 9.

[8]The White House. "Fact Sheet—Statement on National Space Transportation Policy," 5 August 1994, n.p.; on-line, Internet, 8 February 1997, available from http://www1.whitehouse.gov/WH/EOP/OSTP/other/launchst.html.

[9]Ibid.

[10]Ibid.

[11]House, *Statement of the Deputy Under Secretary of Defense for Space, Robert V. Davis, before the Subcommittee on Space and Aeronautics of the House Committee on Science*, 12 June 1996, 6.

[12]Chapman, 77.

Notes

[13]Lt Col John London III, *LEO on the Cheap: Methods for Drastic Reductions in Space Launch Costs*, Research Report no. AU-ARI-93-8 (Maxwell AFB, Ala.: Air University Press, October 1994), 2.

[14]Ibid., 4.

[15]Ibid.

[16]Ibid.

Chapter 3

Assessment of the EELV Acquisition

> *. . . the Air Force is assigned a vital, national defense mission of assured access to space for our satellites, which are fundamental to national security. This is not only a military mission, but a warfighting mission.*
>
> Dr. Sheila Widnall, SECAF

From the DOD's perspective, a key challenge for the acquisition community is to deliver a spacelift system that satisfies a number of requirements. First, it must follow the NSTP guidance for an evolved (read as low-risk) launch capability at reduced cost. Second, it must meet the overall NMM requirements. Third, it must satisfy the spacelift needs of the combatant commander. This chapter examines the impact that acquisition streamlining may have on these three goals, with an emphasis on how streamlined acquisition may impact the EELV's ability to support the combatant commander.

Streamlined Acquisition and the EELV

Claim

Over the next 25 years, the best option for the nation to realize the NSTP envisioned expendable spacelift cost reductions involves the appropriate application of acquisition streamlining concepts to the EELV program.

Evidence

As discussed in the previous chapter, the president's National Space Transportation Policy requires the EELV to both reduce launch costs and to satisfy the spacelift requirements for a variety of DOD, civil, and commercial users. The National Mission Model best reflects the full implication of this tasking. The NMM is the integrated set of DOD, civil, and commercial spacelift requirements, and the NMM programs the EELV to provide approximately 200 launches in the medium and heavy lift expendable sectors from FY02 through FY20.

The National Space Transportation Policy's conservative guidance therefore prevents the selection of newer, but potentially riskier, near-term solutions to the launch problem. As a result, the DOD plan is to derive a large portion of the cost savings from the acquisition process itself by using streamlining initiatives. The overall intent is to apply these initiatives to the EELV acquisition process. The target is to "reduce the cost of launching the government portion of the National Mission Model by at least 25 to 50 percent over the current systems. This [will save] $5 billion to $10 billion between the years 2002 and 2020."[1]

This sincere commitment to cost reduction, beyond the requirements in the NSTP, is the direct result of upwardly spiraling launch costs and the downsizing measures currently being applied within the United States government. So, even before one can attempt to predict how well the EELV will be able to support the needs of the combatant commander, one must assess the viability of the EELV program within the fiscally constrained DOD environment. In other words, the EELV may only be able to survive budget reductions if the acquisition community is successful in deriving cost savings from planned streamlining initiatives. Examples of such initiatives range all the way from reducing the number of government imposed specifications and other documentation, to finding ways to reduce the number of personnel required for launch base processing of the EELV. The overall intent of these initiatives is to ensure that "EELV is implementing acquisition reform and allowing the contractors to come up with innovative solutions to make space launch more affordable (doing it *better*), reducing time for government evaluations of proposal and data (doing it *faster*), and reducing the burden of massive government oversight inherent in our old ways of doing business (doing it *cheaper*)."[2]

As an example of one of these initiatives, "Lockheed Martin's proposal calls for construction of vertical integration facilities adjacent to the launch pads at Cape Canaveral and Vandenberg, [cutting] the planned time an Atlas [spends] on a pad to an estimated 15-18 hr. [This is] well below the current 30-40 day stay."[3] This time-on-pad reduction translates directly into cost reduction for launch services.

One of the other considerations that will contribute greatly to the potential for success of these streamlining initiatives is that the EELV will be supporting not only the civil and commercial satellite industry, but also the highest priority national security payloads. This interface with the national systems will automatically bring with it the scrutiny and unrelenting interest of officials within the highest levels of the executive and legislative branches of government. The bottom line is that the EELV program will not lose track of its objectives due to the great deal of attention it will undoubtedly receive during its development. The contractors and government program office will not confuse or misinterpret a reduction in government oversight as a reason to deliver a product that does not meet the specified requirements because of constant reminders of the very high profile of the user community.

This “ high level of attention” should not be confused with “excessive oversight,” since the situation is entirely the opposite. The increased emphasis of the DOD in making this program a department-wide example of acquisition reform and acquisition streamlining will further serve to ensure that the EELV program will not become bogged down in tons of red tape and unnecessary overspecification.

As another example of its streamlining initiatives, “the EELV acquisition strategy uses a three-phase ‘rolling downselect’ approach. This strategy emphasizes competition in the critical design phase as the number of contractors decreases from four to two, and then to one.”[4] The first phase of the “rolling downselect” approach began on “. . . 24 Aug [1995] when the Air Force awarded a total of $120 million to four prime contractors for the [EELV] low-cost concept validation module acquisition.”[5] These contractors were Alliant Techsystems, Boeing Defense and Space Group, Lockheed Martin Technologies Inc, and McDonnell Douglas Aerospace. During this phase the Air Force tasked the companies to “. . . produce preliminary designs, trade analyses, and risk reduction demonstrations.”[6]

On 20 December 1996, Secretary of the Air Force Widnall announced that the Air Force selected Lockheed Martin Corporation and McDonnell Douglas Aerospace to continue into phase II of the downselect process. According to Secretary Widnall, “[the contractors] will continue to mature system designs, refine cost estimates, and verify producibility, manufacturing, and affordability improvements.”[7]

“Phase III will begin [in late 1998] with the award of a single, six year contract worth approximately $1.6 billion. During that phase, the contractor accomplishes full scale engineering and manufacturing development of the launch vehicle system.”[8] This phase also contains a requirement for two launches to demonstrate system capability. “The first system test, a medium lift variant, will fly in the year 2001 and the second, a heavy lift variant, is planned for 2003. The goal is to reach Initial Operating Capability (IOC) by 2004.”[9]

As a note, senior policymakers hopefully realize that as a result of budget reductions, and the decision to downselect to a single family of vehicles, “the winning bidder is expected to gain a dominant role in the American launch business. The United States government alone anticipates a need for nearly 200 launches between 2001 and 2020, including 15 heavy-lift missions.”[10] The success of the nation’s national security, civil, and commercial space program will then heavily depend on a single source. This is the risk the nation must rationalize during the current downsizing environment.

So, since a radical solution to the launch problem is not a goal for the EELV, the evolved system must first demonstrate cost control in order to survive the budget wars, even as it seeks ways to better support the combatant commander. The chosen path for success is acquisition streamlining, which is being appropriately applied in this situation because there will be adequate and coordinated high level governmental and commercial interest in the program. The system is evolutionary and not revolutionary (that is, it’s not an inherently risky step forward), and these efforts are being applied to an area that has been long recognized as needing significant improvement.

What Can the EELV Acquisition Learn From the Past?

Claim

The application of streamlining initiatives to the EELV program will only succeed in meeting the program's goals if all levels of management take the time to understand, appreciate and integrate into the program the lessons learned from prior attempts at launch system streamlined acquisition. If this is not done, then the spacelift acquisition community will repeat the mistakes that plagued the development of a system such as the Complementary Expendable Launch Vehicle, and the EELV program will fail to meet, according to SECAF Widnall, "its warfighting mission."

Evidence

As the Air Force proceeds into the EELV acquisition process, and as one examines the history of space launch programs, striking programmatic similarities leap out when one compares the goals and requirements of the EELV program and one of its predecessors, the CELV program.

By the early 1980s, the space shuttle had become the primary and mandated way of getting the nation's highest priority satellites into orbit. However, some key individuals, such as then Under Secretary of the Air Force Aldridge, became concerned about the impacts to national security in the event of a space shuttle launch failure. Such an event would effectively prevent access to space for these critical payloads. "The requirement to reduce dependence on the space [shuttle] for [these] national security payloads prompted consideration of a complementary means to get DOD satellites into orbit."[11] In many respects the CELV program was far ahead of its time with regard to acquisition streamlining initiatives and concept of operations. The goal of the acquisition was to "conduct a competition for the design, development and production of a [CELV] that would be a derivative of today's operational launch systems. The objective was to provide a timely, low risk, cost effective approach that would meet near-term and far-term requirements."[12]

However, this program ran into problems ranging from lack of adequate funding, to lack of adequate high level support for the acquisition strategy, to disagreements between the contractor and the program office regarding the scope of contract deliverables. These problems were eventually corrected only after the launch accidents of 1986 forced a refocusing of attention onto the only available foreseeable means of heavy-lift access to space—the planned CELV.

These overarching requirements for the CELV are strikingly similar to the requirements and methodologies currently levied on the EELV acquisition. This is the primary reason that personnel involved with the EELV should ensure that they are aware of the lessons learned during the early phases of the CELV acquisition.

In order to illustrate this point, this essay will examine two of the most significant lessons of the CELV acquisition. A more comprehensive review of these and other CELV lessons are found in Maj Terrence Crossey's Air Command and Staff College report number 87-0590, entitled "Lessons Learned—Complementary Expendable Launch Vehicle Acquisition." This report should be mandatory reading for those involved with the EELV acquisition.

The first lesson to be explored, is that "Program Office manning for a new acquisition needs to be determined according to the level and complexity of the program.

[With the CELV acquisition], a three-man program office could not effectively manage a $2.1 billion contract."[13] Although this lesson learned may appear to be absolutely obvious and self explanatory, there are tremendous pressures at work today, under the guise of "acquisition streamlining initiatives," to minimize the size of program offices. As an overall goal, one should pursue these streamlining initiatives, but more importantly, the program office should be sized to be consistent with both the complexity and priority of the program.

There are many important design and operations related decisions made in the initial stages of the program. These decisions must receive an adequate amount of review within the program office. The best way to do this is to ensure that the office is appropriately staffed with the numbers and expertise required to do the job.

Although it may be nice to say that there is a small office running a big program, the reality is that there are still only 24 hours in each day, and humans still need a finite amount of time to perform their responsibilities. Therefore, if the office is inappropriately staffed, some things will not be done, or will be improperly accomplished. The impacts of such events may not be immediately apparent, but the customer may feel their effects down the road where it becomes too expensive (in time or dollars) to correct the situation.

The EELV is critical to our efforts in space, and as Major Crossey points out, "the government in the end will be held responsible for all acquisition issues and decisions. So it must be adequately prepared and manned to support the processes leading to these decisions."[14] Acquisition streamlining should not be used as an excuse to decimate the ranks of the program office.

Another lesson learned is "... the government must develop acquisition strategies that are supported by Congress, higher headquarters, and users, and that are consistent with program objectives."[15] Unlike the CELV experience, the EELV acquisition streamlining initiatives are fully supported at all levels within the executive and legislative branches of government. As discussed previously, the EELV program is being conducted within a fiscally constrained and conservatively defined requirements environment. The requirements for this program are well understood by both the DOD and commercial users, and have received an unprecedented level of support, both fiscally, and politically, from both communities.

This level of support is seen in a number of ways. These include congressional funding for the program, the NSTP requirements, the designation of the program in 1994 as a DOD acquisition reform "lead program," and the heavy user involvement in the program. In an effort to ensure the continued participation of the users in program development, "the EELV program established a Payload Interface Working Group, and a Standard Interface Working Group to address the development of the interfaces required by the launch vehicle."[16]

There are 36 additional lessons learned outlined in Major Crossey's paper. Although it's outside the scope of this essay to examine all of them, the point is quite clear there is a wealth of information to be learned and applied from the CELV experience to the EELV acquisition. Everyone associated with the EELV program should take the time to read and understand his lessons learned and recommendations. It would border on negligence to ignore the past when dealing with the present and the future.

As discussed in this chapter, acquisition streamlining is of central importance to the EELV program because of the program's launch services cost reduction goals, and its strategy to develop an evolutionary, as opposed to revolutionary, launch vehicle. The promise of reduced costs will most likely result from a proper application of these streamlining principles. The next chapter examines how this combination of a conservative strategy and acquisition streamlining will affect the combatant commander's ability to integrate space assets into planned conflict resolution strategies.

Notes

[1] "Evolved Expendable Launch Vehicle," *USAF Fact Sheet,* Dec 1996, n.p.; on-line, Internet, 12 January 1997, available from http://www.laafb.af.mil/SMC/PA/Fact_Sheets/eelv_fs.htm.

[2] Assistant SECAF (Acquisition). "Acquisition Reform Success Story," no date, n.p.; on-line, Internet, 8 October 1996, available from http://www.safaq.hq.af.mil/.

[3] Joseph C. Anselmo, "Air Force Readies Pick of Two EELV Finalists," *Aviation Week and Space Technology,* 9 December 1996, 3.

[4] "Evolved Expendable Launch Vehicle," *USAF Fact Sheet,* Dec 1996.

[5] "Space Launch Contract Awarded," *Air Force News Service,* 25 August 1995, n.p.; on-line, Internet, 2 November 1996, available from http://www.af.mil/news/Aug1995/n19950825_937.html.

[6] "Evolved Expendable Launch Vehicle," *USAF Fact Sheet,* Dec 1996.

[7] "Air Force Awards Contracts for Evolved Expendable Launch Vehicle," *Air Force News Service,* 23 December 1996, n.p.; on-line, Internet, 12 January 1997, available from http://www.dtic.mil/cgi-bin/waisgate?WAISdocID=2245920054+2+0+0&WAISaction=retrieve

[8] "Evolved Expendable Launch Vehicle," *USAF Fact Sheet,* Dec 1996.

[9] Ibid., n.p.

[10] Joseph C. Anselmo and Bruce A. Smith, "Cost Drives the EELV Wins," *Aviation Week and Space Technology,* 6 January 1997, 27.

[11] Edward C. Aldridge Jr., "An Assured Space Launcher for DOD," *Defense 85,* August 1985, 10.

[12] Ibid.

[13] Maj Terrence G. Crossey, *Lessons Learned - Complementary Expendable Launch Vehicle Acquisition,* Research Report no. 87-0590 (Maxwell AFB, Ala.: Air University Press, April 1987), 21.

[14] Ibid.

[15] Ibid., 22.

Notes

[16]Deputy Under Secretary of Defense for Space, Robert V. Davis, *"Statement Before the Subcommittee on Space and Aeronautics of the House Committee on Science,"* (Washington, D.C., 12 June 1996), 6.

Chapter 4

Will the EELV Increase Combat Capability?

> *The strategic context confronting the United States is unique, and our friends, allies, and interests are worldwide. Accordingly, the arena of our potential operations is the entire planet with its surrounding aerospace, from the ocean depths to geosynchronous orbit and beyond.*
>
> Joint Pub 1, Chapter 1

While the previous chapter focused on the impact of the acquisition process itself on the EELV, this chapter first explores and assesses the system performance requirements for the EELV in light of the program's genesis as part of the President's National Space Transportation Policy. It also discusses the EELV's impact on the nation's warfighting capabilities. Specifically, this chapter examines the extent to which the EELV will contribute to or hamper the mission of the combatant commander as that individual executes assigned missions under direction of the National Command Authority (NCA).

EELV Performance Requirements

Claim

After examining the current contractual requirements for the EELV, one will conclude that this acquisition program will deliver a launch system that will maintain and not significantly improve our current launch capability. Also, the expected 25% to 50% reduction in launch costs is a goal that may not be achieved.

Evidence

It is one of the unwritten rules of systems acquisition that when one gets to the bottom line of any dispute between the contractor and the customer, one most often finds the resolution in the contract that originated the agreement for goods and services. Using this guidance, if one wishes to determine what a contractor is most likely to deliver under the law, then one needs to take a close at the contract.

In this case, the System Performance Document, Annex 6 to the Pre-Engineering Manufacturing and Development Call For Improvement (CFI), contains the top-level contractual system performance requirements for the program. This document "is intended to be the foundation for the Contractor prepared System/Segment/Subsystem Specifications. [It] identifies the EELV system performance requirements and goals derived from the EELV Operational Requirements Document (ORD) [produced by Air Force Space Command]."[1]

The author bases this claim on the information in the SPD versus the ORD, since the contractors will use the SPD to deliver the EELV system. A second reason is that by using the SPD, one can readily ascertain the traceability of program requirements from the National Space Transportation Policy to the delivered product. The following definition is critical to understanding the relative priorities of requirements stated in the SPD:

> In sections [of the SPD] denoted by an (*) and in subsections thereof, quantitative requirements designated as threshold values are non-tradable and must be met or exceeded by the EELV system. Quantitative values stated as objectives or goals are tradable. If both a threshold and an objective/goal value are provided, the trade space is between these values. Threshold values for all other requirements should be met unless doing so would have a significant adverse impact on program costs. If only an

> objective/goal value is provided, the system must provide some capability with respect to the subject requirement, the magnitude of that capability being determined by trades considering performance and cost.[2]

The significance of the above definition is that in the end, the only clear point in the requirements definition environment is that the contractor is only absolutely required to deliver the threshold and objective requirements designated with an (*). These requirements are usually referred to as key performance parameters (KPPs). The idea is that if a contractor fails to meet the requirements identified as KPPs, the contractor will then be considered as not performing to the standards agreed to in the contract. The contractor could then face loss of profit, or in some cases, legal action. By examining the KPPs in the SPD, one can get a flavor regarding the general direction and capabilities emphasized by the customer, which in this case is the EELV program office.

When considering non-KPP threshold and objective requirements, there is some room for the contractor to attempt to convince the government that either the requirement could not be fulfilled, or for some other reasons, the cost would become prohibitive to fulfilling the overall program requirement.

A review of these EELV pre-Engineering, Manufacturing and Development Call For Improvement Key Performance Parameters results in a clear program emphasis on first preserving the capability to launch and place the required payload masses accurately and reliably into their assigned orbits. The next level of requirements priority is to reduce launch costs, and the third level of requirements is to improve the EELV's performance in a warfighting mission.

To support this assertion, the system performance document key performance parameter requirement categories include the requirements paragraphs dealing with:

1. Mass to orbit; performance accuracy
2. Vehicle design reliability
3. Ability of the launch pads to eventually accommodate either the medium or heavy lift versions of the EELV
4. Standard payload interfaces
5. The basic launch rate required for the program

It is important to understand what this means. The SPD considers the above categories to be critical to the program. This is what the contractor will immediately clue in on because these requirements must be met in order for the company to be considered in compliance with the contract. An examination of these KPPs reveals that they all deal only with safely delivering a payload to the agreed-to orbital location. They say little about the cost of accomplishing the task or the timeliness and flexibility of the system launching the payload into space.

Cost reduction is not listed as one of the SPD KPPs. It shows up as a second tier requirement (in my priority scheme), listed as a non-KPP threshold requirement as follows:

> Using current systems as a cost baseline, the total Life Cycle Cost (less the $2 billion for development) and the annual fixed cost for launching the Government portion of the NMM shall be reduced by 25% (threshold) from those of current launch systems. An objective is a 50% reduction in these costs.[3]

This wording means that in the end, the contractor may not have to deliver on the envisioned 25 percent reduction in launch costs that everyone, up through the highest levels of government, has been repeatedly professing to be the goal of the EELV acquisition. In no way is the author saying that the contractor would intentionally try to mislead the government. However, as far as a clear cut requirement, since cost is not a KPP, then the expected reduction in launch costs may not really come to fruition.

EELV and the Combatant Commander

Claim

Since the DOD's spacelift capability from FY02 through FY20 will primarily be based on the EELV, this launch system will become CINCSPACE's major critical shortfall for both deliberate and crisis action planning, as he (she) attempts to implement a number of combatant commander responsibilities outlined in the National Military Strategy (NMS), Joint Publication 5-0 *Doctrine for Planning Joint Operations,* and the Chairman of the Joint Chiefs of Staff's *Joint Vision 2010.*

Evidence

In order to understand why this launch system will be CINCSPACE's major critical shortfall, one first needs to understand and appreciate the often time sensitive strategy-to-task framework the combatant commander uses to respond to National Command Authority taskings for both deliberate and crisis action planning.

The strategy-to-task framework begins with the National Security Strategy of Engagement and Enlargement (NSSEE) of the United States that has three central goals. Of these three, one of them aims to "enhance our security with military forces that are ready to fight and with effective representation abroad."[4] The document goes on to state that "our nation must maintain military forces sufficient to deter diverse threats and, when necessary, to fight and win against our adversaries."[5] Additionally, the NSSEE stipulates that "to meet all of these requirements successfully, our forces must be capable of responding quickly and operating effectively as a joint team."[6] This guidance then flows down into the National Military Strategy which outlines the tasks the combatant commander performs while planning to fight as part of a joint or combined force.

The two objectives of the NMS are to promote stability and thwart aggression. Within the second objective, one of the key components is to fight and win, and this component of the NMS is then further subdivided into several tasks, one of which is to "fight combined and fight joint."[7] The NMS goes on to say that "each of the services provides trained and ready forces to support the warfighting commanders' warfighting plans and operations."[8]

Thus "joint operation planning is an inherent command responsibility established by law and directive, with the Chairman of the Joint Chiefs of Staff and the combatant commanders having the primary responsibility for planning the employment of joint forces."[9]

The combatant commanders "translate national and theater strategy into strategic and operational concepts through the development of campaign plans, and [these campaign plans encompass] both the deliberate planning and crisis action planning processes."[10] Both deliberate and crisis action planning are geared toward creating operational plans that are to be used in response to contingencies requiring the use of military forces. The major difference between the two is that deliberate planning occurs in peacetime, while crisis action planning is "based on current events and conducted in time-sensitive situations and emergencies."[11]

It is within this often time-sensitive environment that the NCA tasks the combatant commander to arrive at proposed courses of action for crisis response. The combatant commander then uses elements of the Joint Operation Planning and Execution System to develop the Operations Plan (OPLAN). This OPLAN contains everything about the mission, such as the forces to be used, the deployment schedules, task assignments, logistics, airlift, sealift, and space requirements, among others.

It is from this point of view that the combatant commander will assess the ability of the EELV to support his (her) mission. The combatant commander will be looking for timely, responsive, flexible, and rapid spacelift support. Will the EELV be able to deliver?

The author's assessment is that the EELV will not be able to meet the combatant commander's expectations. This deficiency will not exist because the acquisition community fielded a "poor" system, but because the requirements for the system, from the NSTP to the contractually obligating system performance document, did not require the EELV acquisition program to deliver a system which would meet the spacelift needs of the combatant commander. The NSTP describes the EELV as an interim capability, until the future delivery of a drastically improved spacelift system, the Reusable Launch Vehicle. Therefore, these conservative EELV requirements are reflected all the way down the chain, and will result in the delivery of a spacelift system which may be somewhat improved over today's systems, but it will be far short of the rapid, responsive, and flexible capability needed to maximize the war-winning potential of space-based resources.

Notes

[1]"EELV Pre-Engineering Manufacturing and Development Call For Improvement Annex 6, System Performance Document, CFI# F04701-96-R-0008." *EELV Program Office Home Page,* 1996, n.p.; on-line, Internet, December 1996, available from http://www.laafb.af.mil/SMC/MV/eelvhome.htm, 140.

[2]Ibid.

Notes

[3]Ibid.,149.

[4]The White House, *A National Security Strategy of Engagement and Enlargement,* February 1996, i.

[5]Ibid., 3.

[6]Ibid., 13.

[7]Chairman of the Joint Chiefs of Staff, *National Military Strategy of the United States of America,* 1995, 4.

[8]Ibid., 14.

[9]Joint Publication 5-0, *Doctrine for Planning Joint Operations,* 13 April 1995, I-4.

[10]Ibid., ix.

[11]Ibid.

Chapter 5

Conclusions

> *Rapid-response spacelift must be available to emplace and replace critical space assets.* ***.*** *Failure of these assets or their destruction by enemy action could lead to disastrous consequences unless they can be quickly replaced.*
>
> Air Force Manual 1-1, Vol I, pp 14

According to *Global Engagement: A Vision for the 21st Century Air Force*, "we are now transitioning from an *air* force to an *air and space* force on an evolutionary path to a *space and air force*."[1] In this document, Secretary Widnall and Air Force Chief of Staff, Gen Ronald Fogleman also go on to say that the Global Engagement vision "embodies [their] belief that in the 21st Century, the strategic instrument of choice will be air and space power."[2] Such statements give great credibility to the strong effort by the Air Force and the DOD to capitalize on the war-winning potential of space-based assets. These senior leaders have concluded that spacepower will play a crucial role in determining the outcomes of future conflicts. However, while space assets may hold the key to future victory, they must first be transported from earth to orbit in order to become part of the combatant commander's toolkit for conflict resolution. Space assets are useless to the fight, unless the nation's spacelift capability can dependably deploy them when and where needed in order to support the overall combatant commander's campaign plan.

The capability to use spacelift to deploy space assets as part of a war-winning strategy is not cost-free. These ever-increasing costs have resulted in spacelift cost-control becoming the core of an effort by the National Command Authority to redefine and reorient the nation's spacelift capability. The near-term course of action chosen by the NCA to correct the situation calls for the acquisition of the EELV system as the means to satisfy the National Mission Model and to lower launch services costs.

When finally delivered, the EELV will be the product of both the requirements definition and acquisition systems. Together, these systems will set the parameters for United States performance in space. As a product of these two systems, the EELV will determine the United States role in space from the commercial, civil, and warfighting perspectives. This single launch system will heavily influence the way we fight future wars because it will become a warfighting instrument only if it meets the timely, flexible, and responsive spacelift needs of the combatant commander.

This paper reviewed the requirements for the EELV, as well as the appropriateness and impact of the streamlined acquisition system being used to procure the system in order to determine if this launch system would become part of the combatant commander's toolkit. The following paragraphs outline a summary of the findings.

Summary of Findings

Finding I

The EELV is a conservative, interim attempt to solve the national problem of access to space. The guiding source for this acquisition program is the NSTP, signed by President Clinton in 1994. It lays out near-term (the EELV and Space Shuttle) and long term (the RLV) solutions for the nation's launch systems. The direction to evolve the EELV from current capabilities therefore does not hold out much promise for significant improvement of spacelift in some of the areas that could directly have a positive impact on United States warfighting ability.

Finding II

A family of launch vehicles, as opposed to a single launch vehicle, is the preferable solution since a single "one-size-fits-all" launch system would be too costly. A gross analysis shows that due to the NSTP's direction to evolve the EELV from current systems, a single launch vehicle would require the selection of a system from the heavy-lift class in order to meet all requirements. This then infers that unless customers use ridesharing, a current medium launch vehicle user may be subjected to a fourfold increase in launch services costs to get the same payload to orbit. This is clearly unacceptable.

Finding III

The success or failure of the EELV's acquisition process will depend heavily on the proper application of streamlining initiatives since the program is tasked to simultaneously produce cost reductions in launch services and improvements in launch operations. These twin challenges will often compete within the program, and the danger lies with improper tradeoffs between the two goals. Since cost reduction is a very real and important goal for the program, the incorrect application of streamlining initiatives could lead to the delivery of a product that does not meet the requirements set out for the program. The program office must therefore strive to prevent such occurrences, learning from other current or past programs.

One can learn a number of valuable lessons from an earlier acquisition program—the Complementary Expendable Launch Vehicle. Program personnel should study these lessons learned in order not to repeat the same mistakes. The CELV acquisition was very similar in a number of ways. It was a program planned as an interim spacelift solution; it envisioned the use of acquisition streamlining initiatives, such as the minimized use of specifications and regulations; and it originally attempted to use a small program office to acquire a billion-dollar system.

Finding IV

The EELV requirements, as spelled out in the contractually binding System Performance Document, does not describe a launch system being designed to meet the portion of the AFM 1-1 guidance describing the need for rapid, responsive spacelift. The SPD reflects the cautious, conservative tone of the NSTP, and not the high operations tempo tone of the joint planning environment.

Finding V

The combatant commander will be unable to use the availability of rapid, responsive, timely, and flexible spacelift as an assumption during deliberate or crisis action planning. Although spacelift may be improved, the EELV will not become an integrated member of the combatant commander's "toolbox." It will not be able to satisfy the high operations tempo and fluid situational demands that are expected in the joint warfighting environment.

When taken as a whole, these findings indicate that the EELV system will be able to maintain the near-term capability for reliable United States access to space. However, due to the conservative requirements driving system development, the EELV will not be as flexible and as responsive as needed by the combatant commander. The following recommendations offer a number of courses of action to positively influence the EELV acquisition in order to produce a spacelift system that the combatant commander can more fully integrate into his (her) warfighting arsenal.

Recommendations

(1) Modify the EELV requirements documents to make timeliness and responsiveness key performance parameters. If these requirements are not stated as KPP's, then the resulting launch system may not be flexible and responsive enough to support the combatant commander. This change in system requirements must start with the conservative top-level system development guidance contained in the NSTP. In addition to calling for an evolved system, the NSTP guidance must reflect an acknowledgment of the critical role that spacelift plays in the overall support by space assets to the combatant commander. This acknowledgment, in and of itself, will then result in the flow-down of requirements for a more supportive system to lower level requirements documents and the EELV contract.

(2) Ensure every person involved with the EELV acquisition becomes aware of prior lessons learned with the CELV acquisition. The CELV and EELV programs are so similar that it would be well worth the effort to learn all that is possible from the failures and successes experienced by the CELV program during those turbulent days.

(3) Continue to educate the acquisition staffs on the space-based warfighting needs of the combatant commander. They must understand spacelift's warfighting mission, which

will lead to more of an operational focus to this acquisition process. If the staffs can increase their appreciation for why responsiveness, timeliness, and flexibility are key warfighting components, this will contribute to a much better EELV product.

(4) Educate the warfighting staffs on the true capabilities and limitations of this spacelift system. This is doubly important since while the EELV will be a critical element providing the combatant commander with his (her) space-based capability, the system itself will not be the type of warfighting system that can function smoothly within the warfighting decision cycle.

Implications of the Study

The implications of this study are great and far reaching, both in the areas of space system acquisition and space asset participation in joint force operations. In essence, the study discusses the bottom line rationale for doing acquisitions in the first place. Normally, the DOD acquires a new capability to fill a need that cannot be filled either through existing capabilities, training, or procedure modification. In this case, the need from the military perspective is to deliver a spacelift capability that meets the needs of the combatant commander by being able to be integrated into the deliberate and crisis action planning systems. It is with these two planning systems that we will fight our future wars, and this is the level of need we should primarily aim to satisfy.

As far as the EELV acquisition is concerned, the question becomes, why is the DOD procuring a system primarily aimed at the safe delivery of the payload to orbit, and not one also emphasizing the timely, responsive, and flexible needs of the combatant commander. To ascertain what will be delivered, one only has to look at the key performance requirements in the contractually binding EELV system performance document. The delivered item will be a system that may not be more responsive to the warfighter's needs than the systems we are using today.

If space superiority is truly to be an Air Force core competency, then there should be maximum effort to ensure the space systems being procured by the DOD will meet the high operations tempo environment of the combatant commander. The DOD must ensure that such methods as acquisition streamlining are charged to also emphasize the warfighter's requirements, and not just cost savings. If this is not done, then there is no certainty that the end product of the EELV acquisition will meet the combatant commander's expectations and requirements in the area of "rapid-response spacelift."[3]

Senior DOD managers must take near-term decisive action to correct the situation by refocusing the EELV requirements towards a more operationally oriented product for use by the war fighter. If the decision-makers take no action, then within the time-sensitive crisis response environment, the EELV may not be able to deploy space assets when needed to support the combatant commander. With such a shortfall, the nation's forces could fail to achieve space superiority and Full Spectrum Dominance over the enemy.

Notes

[1]Department of the Air Force, *Global Engagement: A Vision for the 21st Century Air Force*, 1997, 7.

[2]Ibid., n.p.

[3]Air Force Manual 1-1, Vol I, *Basic Aerospace Doctrine of the United States Air Force,* March 1992, 14.

Appendix A

White House Statement on the National Space Transportation Policy

THE WHITE HOUSE
Office of Science and Technology Policy
August 5, 1994
STATEMENT ON NATIONAL SPACE TRANSPORTATION POLICY

The White House today released a new National Space Transportation Policy document, as developed by the National Science and Technology Council and approved by President Clinton. The policy sets a clear course for the nation's space program, providing a coherent strategy for supporting and strengthening U.S. space launch capability to meet the growing needs of the civilian, national security and commercial sectors.

The policy commits the nation to a two-track strategy of: (1) maintaining and improving the current fleet of expendable launch vehicles as necessary to meet civil, commercial, and national security requirements; and (2) investing R&D resources in developing and demonstrating next generation reusable space transportation systems with the potential to greatly reduce the cost of access to space.

The new policy accomplishes four fundamental objectives: 1) Establishes new national policy for federal space transportation spending, consistent with current budget constraints and the opportunities presented by emerging technologies. Under the new policy, DoD will assume the lead responsibility for modernization of the current expendable launch vehicle fleet. NASA will assume the lead responsibility for research and development of next generation reusable systems. NASA will focus their investments on technologies to support a decision no later than December 1996 on whether to proceed with a flight demonstration program. This program would, in turn, provide the basis for deciding by the end of the decade whether to proceed with a new launch system to replace the aging Shuttle fleet. 2) Establishes policy on federal agencies' use of foreign launch systems and components. With the end of the Cold War, it is important for the U.S. to be in a position to capitalize on foreign technologies—including Russian technologies—without, at the same time, becoming dependent on them. The policy allows the use of foreign components, technologies and (under certain conditions) foreign launch services, consistent with U.S. national security, foreign policy and commercial space guidelines in the policy. 3) Establishes policy on federal agencies' use of excess U.S. ballistic missile assets for space launch, to prevent adverse impacts on the U.S. commercial space launch industry. Under START, these assets may be used in certain circumstances for civilian space launch. A serious concern in developing the policy was the possible impact that widespread government use of these assets could have on U.S. commercial launch companies. The policy obliges the government to fully consider commercial services as part of the decision making process and imposes specific criteria on the use of excess assets. 4) Provides for an expanded private sector role in the federal space transportation R&D decision making processes.

In contrast with previous national policy on space transportation, this policy specifically directs the Departments of Transportation and Commerce to identify opportunities for government-industry cooperation and to factor these into NASA's and DoD's implementation plans. These steps will help keep America at the forefront of space transportation technology, while ensuring that we have a robust and reliable expendable launch vehicle fleet.

Glossary

ACSC	Air Command and Staff College
AU	Air University
CELV	Complementary Expendable Launch Vehicle
CFI	Call For Improvement
CINC	Commander in Chief
CINCSPACE	Commander in Chief, United States Space Command
DOD	Department of Defense
EELV	Evolved Expendable Launch Vehicle
ELV	Expendable Launch Vehicle
EMD	Engineering Manufacturing and Development
FSD	Full Spectrum Dominance
GPS	Global Positioning System
ICBM	Intercontinental Ballistic Missile
IOC	Initial Operations Capability
JOPES	Joint Operation Planning and Execution System
KPP	Key Performance Parameter
LEO	Low Earth Orbit
NASA	National Aeronautics and Space Administration
NCA	National Command Authority
NMM	National Mission Model
NMS	National Military Strategy
NSSEE	National Security Strategy of Engagement and Enlargement
NSTP	National Space Transportation Policy
OPLAN	Operations Plan
ORD	Operational Requirements Document

R&D	Research and Development
RLV	Reusable Launch Vehicle
SECAF	Secretary of the Air Force
SPD	System Performance Document

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